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NOTES ON NORTH AMERICAN TREES. I. QUERCUS

C. S. SARGENT

QUERCUS TEXANA Buckley.—The type of this species grows on dry limestone hills in the neighborhood of Austin, Texas. Here it is a small tree not more than 7-10 m. high and often a large shrub rather than a tree. The branchlets are slender, glabrous or rarely pubescent, and red or reddish in color, and the winter buds are ovate, acute, with reddish, slightly or densely pubescent scales, and usually 4-6.5 cm. in length. The leaves, which are usually of the same shape on upper and lower branches, are deeply divided by broad sinuses rounded in the bottom into 5-7 lobes, the upper lobe 3-lobed at apex, the lateral lobes broad and more or less divided at apex into acuminate lobes, with the exception of those of the lowest pair which are much reduced and less deeply lobed; the base of the leaf is broadly cuneate or concave-cuneate. The leaves are only occasionally furnished on the lower surface with small axillary tufts of pale hairs; when they unfold they are thickly coated on both surfaces with pubescence and are often bright red. On the small trees growing on the dry hills of central Texas the acorn is about 1.5 cm. long and inclosed for one-quarter to one-half its length in a turbinate cup covered with thin, closely appressed, pubescent scales rounded at the narrow apex. Descending sometimes from the hills into better soil, the Texas oak grows taller and produces fruit occasionally 2.5 cm. in length, with a turbinate cup comparably less deep than that of the smaller fruit produced on the neighboring hills. On the Edwards Plateau in western Texas trees occur with acorns acute at apex, about 2 cm. long and only 7 or 8 mm. in diameter. On some trees in this region the leaves are 5-lobed with broad shallow sinuses. The following forms from western Texas can be distinguished:

QUERCUS TEXANA var. *chesosensis*, n. var.—Differing from the type in the acuminate lobes of the leaves and smaller cups.

Dry rocky lower slopes of the Chisos Mountains, Brewster County, Texas, *G. B. Sudworth*, November 15, 1913.

The leaves of this variety are oblong to oblong-obovate in outline, broadly cuneate or occasionally sharply cuneate at base, divided by broad sinuses rounded in the bottom into 5 or 7 narrow acuminate spine-tipped lobes, the lateral entire, the elongated terminal lobe slightly 3-lobed at apex; they are thick, lustrous on the upper surface and glabrous or sometimes pubescent below, furnished with small axillary tufts of hairs, 5-10 cm. long and 2-8 cm. wide, the terminal lobe of the larger leaves being sometimes 5 cm. in length; petioles slender, glabrous, often tinged with red, 5-15 cm. long. The nut is about 8 mm. long and 5 mm. in diameter, pointed and tomentose at apex, and inclosed for one-quarter of its length in a turbinate cup covered with the thin scales rounded at apex of *Q. texana*.

It is a shrub or small tree with slender, glabrous, bright orange red branchlets becoming reddish brown in the second year, and acute winter buds 4-5 mm. long covered with brown more or less tomentose scales. It is possible that this is the oak from the mouth of the Pecos River described by TORREY (Bot. Mex. Bound. Surv. 206. 1858) as *Q. coccinea* var. *microcarpa*.

A specimen of a plant which differs only from those from the Chicos Mountains in the darker color of the branchlets was collected by *Buckley* in 1875 near Fort Davis, in Jeff Davis County, Texas. The shape of the leaves of these trees is very different from those of *Q. texana* of central Texas, and in spite of the similarity of the fruit it may be possible, when more material is available, to separate this form specifically.

QUERCUS TEXANA var. **stellapila**, n. var.—Differing from the type in the clusters of fascicled hairs which cover both surfaces of the mature leaves and the branchlets of the year.

Sproul's Ranch above Fort Davis, Davis County, Texas, alt. 2000 m., *D. M. Andrews* (no. 74, type), August 25, 1913.

The leaves of this variety, which is a small tree, are thick, dark bluish green above, yellowish below, oblong-obovate, acuminate at apex, cuneate or occasionally rounded at base, and divided by wide shallow sinuses rounded in the bottom into broad usually entire acute lobes. They are 7-12 cm. long and 5-7 cm. wide; petioles slender, 5-6 cm. in length. The fruit, although slightly larger, cannot be distinguished from that of var. *chesosensis*. This tree in the shape of the leaves, their short petioles, and in the persistent fascicled hairs which cover them and the branchlets is the most distinct of the forms which I refer to *Q. texana*.

In the paper in which he described *Quercus texana* BUCKLEY described another Texas oak:

QUERCUS SHUMARDII Buckley, Proc. Acad. Nat. Sci. Phil. 1860. 444.—*Quercus rubra* var. *texana* Buckley, loc. cit. 1881. 123.—This is a large tree of low woods, with grayish or grayish brown

branchlets and oblong-ovate acute winter buds 5–6 cm. in length, covered with glabrous or rarely slightly pubescent yellowish brown scales scarious on the margins. The leaves are always furnished below with large conspicuous tufts of hairs in the axils of the veins and on the upper branchlets are deeply divided by broad sinuses into narrow acute lobes, and although often larger resemble in shape those of *Q. texana*, but the lower leaves are 7-lobed with short broad lobes separated by narrow sinuses pointed or rounded in the bottom, and are often 15–20 cm. long and 10–12 cm. wide, and are broadly acuminate or truncate at base. The nuts are oblong-ovate, narrowed and rounded at apex, frequently 3 cm. long and 2 cm. in diameter, the base only inclosed in a shallow saucer-shaped cup covered with thin or often with conspicuously tuberculate pale pubescent or nearly glabrous scales. Leaves of sterile branchlets from the tops of this tree are often difficult to distinguish from those of *Q. texana*, and the best characters by which these oaks can be distinguished are found in the red brown more or less pubescent buds and reddish branchlets of *Q. texana* and its varieties, and in the usually glabrous grayish buds and grayish branchlets of *Q. Shumardii* and its variety. The close relationship of these trees is shown, however, in the occasional occurrence in Missouri of trees of *Q. Shumardii* with reddish, slightly pubescent buds and reddish branchlets.

Quercus Shumardii ranges from eastern Texas through the valley of the Mississippi River to northern Missouri, southern Illinois and Indiana, and western Ohio, and through the Gulf and south Atlantic states to North Carolina. Under favorable conditions it becomes one of the largest of American oaks, and individuals up to 40 m. in height with trunks 1.5 m. in diameter and much buttressed at the base are not rare. Trees with the much thickened and with the thin cup-scales grow together over the whole region occupied by this species. The fruit with thin cup-scales is often difficult to distinguish from that of the northern red oak, and it is *Q. Shumardii* which has often been mistaken for it in the eastern Gulf states, where the northern tree is extremely rare, and in southern Missouri and in Texas, where it does not appear to grow.

On the trees with the saucer-shaped cups others occur with deep cup-shaped cups. This is the *Q. Schneckii* Britton, and as the trees with the shallow and with the deep cups do not otherwise differ, the latter is best considered a variety of the former. If this view is adopted it becomes

QUERCUS SHUMARDII var. **Schneckii**, n. var.

QUERCUS TEXANA Sargent, Silva N. Am. 8:129 (in part). 1895 (not Buckley).—*Q. Schneckii* Britton, Man. 333. 1901.—Differing from the type in the cup-shaped cups of the fruit covered with thin or rarely toward the base with much thickened scales.

This is the more common form in the Mississippi valley, and although not rare in the Gulf and south Atlantic states, it is less common there than the type. Forms with thickened cup-scales I have seen only on specimens collected by T. G. Harbison "from large wide-spreading trees in low rich soil in river bottoms north of Vicksburg, Mississippi," October 27, 1916.

QUERCUS COCCINEA Moench.—An interesting form of the scarlet oak may be distinguished as

QUERCUS COCCINEA var. **tuberculata**, n. var.—Differing from the type in the much larger fruit, with cup-scales more or less thickened below the middle of the cup-shaped or turbinate cup, those of the upper row thin and forming a distinct marginal ring.

Bluffs of the Alabama River, near Berlin, Dallas County, Alabama. C. S. Sargent, April 19, 1915; R. S. Cocks, August 27, 1915 (no. 912), September 1, 1915 (no. 940), August 24, 1916 (no. 898, type).

In the habit of this oak, which is a large tree, in the bark of the trunk, and in the leaves there is nothing to distinguish it from the typical *Q. coccinea*. The location is exceptional, for this tree ranges south along the Appalachian Mountains and their foothills, and has not been found before east of the Mississippi River south of northern Georgia and northeastern Mississippi. In other parts of the country the cup-scales of *Q. coccinea* sometimes show a tendency to thicken, although in a less degree than those on these Alabama trees; and I have seen specimens with such thickened scales from a tree growing near New Bedford, Massachusetts, and on one from Tennessee without exact locality.

QUERCUS RUBRA L.—The specimen on which LINNAEUS based his *Q. rubra* (*Q. falcata* Michx.) came from Virginia and has ovate to obovate long-stalked leaves narrowed and rounded or cuneate at base, with a long acuminate entire or slightly lobed terminal lobe and 2 or 4 large acuminate lateral lobes pointing forward. Leaves of this form, which must be considered the typical form of *Q. rubra*, are pubescent early in the season on the upper surface, becoming nearly glabrous before autumn. The lower surface is covered more or less thickly with rusty or pale pubescence. This is the common form of the southern red oak in the Atlantic states north of Virginia. On some trees leaves occur which are broadly

obovate and 3-lobed at apex, with rounded or acute lobes, the terminal lobe being sometimes slightly lobed, and are rounded or cuneate at base. On some individuals all the leaves are 3-lobed and these may be distinguished as

QUERCUS RUBRA var. TRILOBA Ashe, Proc. Soc. Am. Foresters 11:90. 1916.—*Q. cuneata* Wangenheim, Nordam. Holz. 78. pl. 5. fig. 14. 1787; *Q. triloba* Michx. Hist. Chênes Amér. no. 14. pl. 26. 1801; *Q. rubra* Abbott and Smith, Insects of Georgia, 1:99. pl. 50. 1797 (not Linnaeus); *Q. falcata* β *triloba* Nutt. Gen. 2:241. 1818.—The leaves of this variety vary from 5 to 8 cm. in length and from 4 to 9 cm. in width, and are glabrous on the upper surface and grayish or yellowish pubescent on the lower surface. So far as I have observed, this variety of the southern red oak does not grow to a large size, and trees more than 10–15 m. tall are not common.

It is nowhere abundant, and the only specimens from the northern states which I have seen were collected by *J. K. Small* in the vicinity of Pleasant Grove, Lancaster County, Pennsylvania, in June 1881, and by *Charles C. Deam* in Jefferson County, Indiana (nos. 16, 253, 18775). On dry uplands near Milledgeville in central Georgia it is the common form of red oak. I have not seen specimens from Louisiana, and only one specimen collected by *E. J. Palmer* (no. 12765) near Houston, Harris County, Texas, from any part of the region west of the Mississippi River.

A form of the southern red oak with oval or oblong leaves deeply divided into 5–11 acuminate often falcate lobes and white-tomentose below may best be considered, as ELLIOTT who first noticed this tree considered it, a variety which now becomes

QUERCUS RUBRA var. PAGODAEFOLIA Ashe, Proc. Soc. Am. Foresters 11:90. 1916.—*Q. falcata* var. β *pagodaeifolia* Elliott, Sk. 2:605. 1824; *Q. pagoda* Rafinesque, Alsograph. Am. 23. 1838; *Q. pagodaeifolia* Ashe, BOT. GAZ. 24:275. 1897; Sargent, Man. 244. fig. 197. 1903.

At one time I believed that this oak might be distinguished specifically from *Q. rubra*, basing my opinion on the paler bark of the trunk, on the shape of the leaves with more numerous and more acuminate lobes, often repand-dentate at the apex, on the whiter pubescence on their lower surface, and on the fact that this tree often grows in lower situations and in moister soil than those which *Q. rubra* selects; but further field observations show that these characters cannot be depended upon. Trees of the two forms grow in low ground and on

uplands. Pale bark occasionally occurs on trees of the typical form and dark bark on trees with the leaves of var. *pagodaefolia*, and leaves typical of the two forms are often found on the same tree.

An oak which has long puzzled the students of our southern trees who have tried to refer it as an extreme form to *Q. rubra* var. *pagodaefolia* has recently been distinguished by ASHE as

QUERCUS RUBRA var. LEUCOPHYLLA Ashe, Bull. Charleston Mus. 13:25. 1917.—Differing from the type in the shape of the leaves, on upper branches nearly as broad as long, deeply divided into 5-7 broad lobes and brownish pubescent below, on lower branches slightly obovate, less deeply divided and only slightly pubescent on the lower surface.

The fact that the leaves on the upper and lower parts of the tree are different, as ASHE points out, has added to the difficulties of understanding this tree. The leaves on upper branches are deeply 5-7-lobed, being broader at the apex than those of var. *pagodaefolia*; they are rounded at base, thick, glabrous on the upper surface and more or less thickly coated below with brownish pubescence, and are usually 10-15 cm. long and 9-15 cm. wide. The leaves on lower branches are slightly obovate, rounded or cuneate at base, and usually 7-lobed; the terminal lobe is acute or rounded and often slightly 3-lobed toward the apex; the lateral lobes of the upper pair are much larger than the others and often slightly lobed at the broad apex; those of the lower pairs are nearly triangular and acute. These leaves are thin, dark green, sometimes pubescent, becoming glabrous on the upper surface, sometimes thickly covered with pale or brown pubescence on the lower surface, and are often 12-25 cm. long and 10-20 cm. wide. Occasionally trees occur on which the leaves are obovate, gradually narrowed from below the middle into a long cuneate base, and only slightly lobed toward the apex with entire acuminate lobes. HARBISON has observed that the hilum of the nut of this variety is pink and that the hilum of other forms of *Q. rubra* is always yellow.

This form of red oak is a large tree, 30-40 m. high, and is found from the coast of Virginia to northern Florida, and through the Gulf states to eastern Texas, ranging northward to northern Arkansas, where it appears in a form in which the lobes of the leaves are rather narrower than those on trees farther south, thus approaching var. *pagodaefolia*. This form of the southern red oak is common in the low woods about River Junction, Florida, where it grows to a very large size, and in central Mississippi. Often the leaves on the lower branches cannot be distinguished by their shape and pubescence from those of *Q. velutina*, and specimens have been referred to that species.

QUERCUS NIGRA L.—In the shape of the leaves the water oak is one of the most variable of the oaks of the United States. In

what must be considered the type of the species, as LINNAEUS based his description on GRONOVIIUS' "*Quercus foliis cuneiformibus obsolete trilobis*" and on CATESBY'S figure (*Nat. Hist. Car.* 1: *pl.* 20), the leaves are oblong-obovate, gradually narrowed and cuneate at base and enlarged often abruptly at the broad rounded entire or occasionally obscurely 3-lobed apex. On trees with such leaves, and especially on vigorous young branchlets, the leaves are sometimes pinnatifid with acute, acuminate, or rounded lobes, or are deeply 3-lobed at apex, or are broadly oblong-obovate and rounded at apex with entire or undulate margins. Occasionally on upper branches a linear-lanceolate leaf similar in shape to those of seedling plants can be found. The leaves of the seedlings differ more from the leaves of older trees than in any other of our oaks, and are linear-lanceolate with entire or undulate margins, or are occasionally lobed with one or two pointed lobes, and are often deeply 3-lobed at the broad apex with acuminate rounded lobes; such leaves are occasionally furnished below the middle with a single acuminate lobe, leaves of all these forms often occurring on one plant less than 1 m. tall. On occasional mature trees all the leaves are trilobed at the apex, and such leaves appear so different from the common form of the water oak that this form may be distinguished as

QUERCUS NIGRA var. *tridentifera*, n. var.—Differing from the type in the oblong-obovate leaves, gradually narrowed below into an elongated cuneate base and gradually widened above into a more or less deeply 3-lobed apex, the lobes rounded or acute.

LOUISIANA.—Near Laurel Hill, West Feliciana Parish, *Cocks* and *Sargent*, April 13, 1916 (type); Loranger, Tangipahoa Parish, *Cocks* and *Sargent*, March 30, 1917; Audubon Park, New Orleans, *R. S. Cocks*, October 8, 1913, *C. S. Sargent*, March 31, 1917.

MISSISSIPPI.—Liberty Road, near Natchez, Adams County, Miss *C. C. Compton*, April 19, 1915; near Jackson, Hinds County, *T. G. Harbison* (no. 82), May 20, 1915.

ALABAMA.—Roadsides near Selma, Dallas County, *C. S. Sargent*, April 19, 1915.

TEXAS.—Navidad River, Lavaca County, low woods, *E. J. Palmer* (no. 9237), March 20, 1916 (no. 9086, with some leaves acute and laterally lobed), March 6, 1916.

VIRGINIA.—Near Suffolk. Nansemond County, A. Rehder, August 18, 1908.

On the tree at Loranger, Louisiana, a few of the leaves are elliptical to oblong-obovate, entire and acuminate at the ends. On Cocks's specimens from New Orleans the leaves at the base of the branches are broad at the apex and distinctly 3-lobed with rounded lobes, and the lobes are narrow and long-acuminate and are often also laterally lobed.

Quercus microcarya Small appears to be only a depauperate form of var. *tridentifera*, which may be called

QUERCUS NIGRA var. TRIDENTIFERA f. **microcarya**, n. f.—*Q. microcarya* Small, Bull. Torr. Bot. Club 28:357. 1901.—Differing from *Q. nigra* var. *tridentifera* in its smaller leaves and fruit and in its dwarf habit.

Crevices in the rocks and in thin dry soil on the slopes of Little Stone Mountain, Dekalb County, Georgia.

Quercus rhombica, n. sp.—Leaves rhombic, rarely oblong-obovate to lanceolate, acute or rounded and apiculate at apex, cuneate at base, the margins entire and slightly undulate, on vigorous shoots occasionally furnished near the middle with a pair of short broad or rounded lobes; when they unfold, deeply tinged with red, covered with short pale caducous pubescence, and furnished below with more or less conspicuous usually persistent tufts of axillary hairs, and at maturity thin, dark green and lustrous on the upper surface, pale on the lower surface, 9–12 cm. long and 3.5–5 cm. wide, with stout conspicuous yellow midribs and slender primary forked veins; turning yellow and falling gradually in early winter; petioles yellow, 5–12 mm. in length. Flowers not seen. Fruit ripening at the end of the second season, sessile or short-stalked; nut ovate, rounded at apex, thickly covered with pale pubescence, about 1 cm. long and 1.5 cm. in diameter, with a thin shell lined with hoary tomentum and pale orange colored cotyledons; cup saucer-shaped to cup-shaped, rounded on the bottom, silky pubescent on the inner surface, the scales reddish brown, rounded at apex, slightly pubescent, loosely appressed with free tips, those of the upper rank thin and ciliate on the margins.

A tree often 40–50 m. high, with a tall trunk 1–1.5 m. in diameter, covered with pale slightly furrowed bark, stout wide spreading smooth branches forming a broad head, and slender glabrous branchlets red brown in their first season and dark gray the following year.

Borders of swamps and low wet woods of the coast region from the Dismal Swamp, Virginia, to eastern Texas; common, especially in southern central Alabama and in Louisiana, where in the western part of the state it extends north of the Red River.

VIRGINIA.—Dismal Swamp, *L. F. Ward*, 1887 (distributed as *Q. aquatica* var. *laurifolia*); *C. L. Pollard*, May 30, 1896.

NORTH CAROLINA.—New Berne, Craven County, *T. G. Harbison*, June 10, 1917 (nos. 3, 4); Wilmington, New Hanover County, *T. G. Harbison*, June 11, 1917 (no. 110); Abbottsburg, Bladen County, *T. G. Harbison*, May 3, 1916.

SOUTH CAROLINA.—Darlington, Darlington County, *T. G. Harbison*, December 10, 1917 (no. 4); Yemassee, Hampton County, *T. G. Harbison*, December 7, 1917 (no. 1).

GEORGIA.—Lumber City, Telfair County, *T. G. Harbison*, May 30, 1917 (no. 9), December 3, 1917 (no. 11).

FLORIDA.—Jacksonville, Duval County, *T. G. Harbison*, December 3, 1917 (nos. 17, 20); San Mateo, Putnam County, *T. G. Harbison*, December 6, 1917 (no. 36); River Junction, Gadsden County, *T. G. Harbison*, April 19, 1917 (no. 110), November 2, 1917 (nos. 141, 156).

ALABAMA.—Cottondale, Tuscaloosa County, *T. G. Harbison*, May 19, 1917 (no. 38); Mount Vernon, Mobile County, *T. G. Harbison*, May 19, 1917 (no. 16); Cedar Creek, near Selma, Dallas County, *R. S. Cocks*, September 20, 1917; Sardis (now Berlin), Dallas County, *R. S. Cocks*, October 2, 1917 (no. 4706, type).

LOUISIANA.—Slidell, St. Tammany Parish, *R. S. Cocks*, September 30, 1917; Mandeville, St. Tammany Parish, *R. S. Cocks*, September 1914 (no. 4698); Springfield, Livingston Parish, *Cocks* and *Sargent*, March 29, 1917, *R. S. Cocks*, October 3, 1917 (no. 4710); Welsh, Jeff Davis Parish, *E. J. Palmer*, September 1915 (no. 8485); Lake Charles, Calcasieu Parish, *C. S. Sargent*, March 24, 1911; Natchitoches, Natchitoches Parish, *E. J. Palmer*, May 4, 1915 (no. 7500); Monroe, Ouachita Parish, *E. J. Palmer*, October 4, 1915 (no. 8934); Pineville, Rapids Parish, *R. S. Cocks*, October 3, 1917 (no. 4702).

TEXAS.—Beaumont, Jefferson County, *E. J. Palmer*, April 22, 1916 (no. 9524), *C. S. Sargent*, March 23, 1917.

Q. rhombica has usually been confounded with *Q. nigra* L. except in Virginia and Louisiana, where it has passed for *Q. laurifolia* Michx. From *Q. nigra* it differs in the shape of the leaves, in its larger fruit with deeper cups, rounded not flat on the bottom and covered with less closely appressed and less pubescent scales, in its paler bark and more persistent leaves. From *Q. laurifolia* it differs in the shape of its thinner leaves which turn yellow and fall gradually in the early winter, and in its larger fruit with much deeper cups.

QUERCUS RHOMBICA var. **obovatifolia**, n. var.—Differing from the type in the obovate leaves at the ends of the branches, rounded or slightly 3-lobed or undulate at the broad apex.

The terminal leaves of this variety, which are sometimes 10-11 cm. long and 6-7 cm. wide, show a relationship with *Q. nigra* L., but typical *Q. rhombica* leaves occur on the same branches. The texture, color, and venation of all the leaves are those of *Q. rhombica*, and the fruit with a cup 2.5 cm. in diameter is that of that species, as are the winter buds and branchlets.

A single tree in low woods, Beaumont, Jefferson County, Texas, *E. J. Palmer*, September 14, 1917 (no. 1274, type).

QUERCUS LAURIFOLIA Michx.—This is one of the least variable of the southern oaks. The branchlets are always glabrous, and the leaves, which are thicker than those of *Q. Phellos* L., are dark green, very lustrous, and glabrous. On the branches figured by MICHAUX the leaves are generally elliptic, but sometimes slightly broadest above the middle, acuminate at the ends, and 6-12.5 cm. in length. Occasionally trees occur on which lanceolate leaves are found, but in its most common form the leaves of the laurel oak are elliptic and usually not more than 7-8 cm. in length. The leaves of seedlings in their first season are broadly obovate, rounded and 3-toothed or lobed at apex, or are often furnished above the middle with short acute lobes. On leading shoots oblong-obovate leaves acute or rounded at apex sometimes occur, and such leaves are occasionally 3-lobed at apex. When the ends of branchlets have been broken or injured by cattle or horses, summer shoots growing from lateral buds often produce only small narrow oblong leaves irregularly divided into narrow acuminate apiculate lobes, but sometimes at the base of summer shoots the leaves are much larger, oblong-obovate, rounded, and obtusely lobed at apex. Usually the leaves of *Q. laurifolia* are acute at apex, but occasionally obovate leaves rounded at apex are found among leaves of normal shape; and on some individual trees all the leaves, although varying much in width, are of this shape. It was for a tree with such leaves that MICHAUX proposed the name of

QUERCUS LAURIFOLIA (HYBRIDA) Michx. *Hist. Chênes Amér. pl.* 18. 1801.—Differing from the type in its obovate leaves rounded at apex.

MICHAUX, although he suggested that this tree might have been a hybrid between the laurel and water oaks, apparently believed that it was a mere variety of the former, which he says it resembled in all other characters. This variety of the laurel oak, although widely distributed, is not common. It is the only form of the laurel oak which I have seen from Virginia, where it was col-

lected on the banks of the Blackwater River, near Zumi, Isle of Wight County, by *A. Rehder* in August 1908. I have seen specimens from New Berne, North Carolina, where it grows in low woods and where it had been planted as a street tree, from Darlington and Bluffton, South Carolina, and from the banks of the Apalachicola River at Chattahoochee, Florida.

QUERCUS LAURIFOLIA var. **tridentata**, n. var.—Differing from the type in its 3-lobed leaves. Leaves oblong-obovate to oblong, gradually narrowed and acute or rounded at base, 3-lobed at apex, often slightly repand below, the terminal lobe acuminate and much larger than the lateral lobes; at maturity thick, glabrous, dark green and lustrous above, paler below, 6–12 cm. long and 2–4 cm. wide, with prominent yellow midribs and primary veins; petioles stout, glabrous, 5–10 mm. in length. Spring leaves and flowers not seen. Fruit as in the type. A large tree with reddish glabrous branchlets, becoming light gray in their second year, and ovate acute puberulous winter buds.

A single tree in a row of planted trees in one of the streets of Orlando, Orange County, Florida, *T. G. Harbison*, December 5, 1917 (no. 26). Three-lobed leaves occasionally occur on vigorous shoots of *Q. laurifolia*, but on this tree all the leaves are 3-lobed and are rather larger than those of the common form of the laurel oak.

As figured by MICHAUX, the cup of the fruit of *Q. laurifolia* is shallow cup-shaped, with rather large and apparently not very closely appressed scales; more often the cup is saucer-shaped and only slightly rounded on the bottom with small closely appressed slightly pubescent scales.

Q. laurifolia, which is one of the most magnificent of the American oaks, is chiefly confined to the coast region, where it is found from Virginia to southern Florida and along the Gulf coast to Mississippi. It is common in the interior of the Florida peninsula, and is not rare in the southern counties of Georgia. From further inland I have seen specimens from Darlington, Darlington County, South Carolina, from the neighborhood of Augusta, Richmond County, Georgia, and from Tuskegee, Macon County, Alabama, but these may have been from planted trees, as the laurel oak has long been a popular street and shade tree in the southeastern states. The laurel oak is not evergreen. Late in the winter the leaves begin gradually to turn yellow and then brown, and when the buds begin to swell at the appearance of spring drop almost simultaneously, leaving the branches bare for a week or two, when they are again covered with unfolding leaves.

QUERCUS CINEREA Michx.—The influence of soil conditions on the growth of trees is well shown by this oak. On dry and sterile

sand hills it is rarely more than 10 m. tall and usually much smaller, with a short trunk and rigid erect branches which form a rather open and unsymmetrical head, but in the richer moist soil of the flats covered by pine woods in the center of the Florida peninsula it is often a tree 20-25 m. high. with a tall trunk and a wide head of gracefully drooping branches. The leaves of *Q. cinerea* are usually entire, but on the ends of branches of occasional trees leaves occur which are oblong-obovate and more or less lobed at the acute or rounded apex, or are divided into short lateral acuminate lobes. This form has been described as

QUERCUS CINEREA β DENTATO-LOBATA A. DC. Prodr. 16²:73. 1864.

Specimens of such leaves I have seen only from Lumber City and Climax, Georgia, San Mateo and Orlando, Florida, and from Cottdonale and Mount Vernon, Alabama, where they were collected in May and November 1917 by T. G. Harbison; from Chestnut, Natchitoches Parish, Louisiana (*Palmer* no. 9471); and from San Augustine, San Augustine County (*Palmer* no. 9511), and Bryan, Brazos County, Texas (*Palmer* no. 10747).

QUERCUS ALBA L.—There are three varieties of the eastern white oak.

1. The tree with leaves deeply divided, sometimes nearly to the midrib, into narrow lobes lanceolate or obovate and often toothed at apex, and sessile or long-stalked fruit, the scales of the cup being often much thickened. This is the *Q. alba* of LINNAEUS, his "*Quercus foliis oblique pinnatifidis: sinubus angulisque obtusis*," as he quotes CATESBY's description and figure which represents this form with deeply divided leaves. It is the *Q. alba pinnatifida* of MICHAUX (*Hist. Chênes Amér. pl. 3. fig. 1. 1801*), who considered it the type, as did MICHAUX fil; and it is this form, although it has been usually treated as a variety in recent years, which must be considered the type of the species.

2. The tree with leaves less deeply divided, with broad rounded lobes and usually smaller generally sessile fruit. This form appears to have been first figured by DU ROI in 1772 in his *Harbk. Baumz. pl. 5. fig. 1*. It is the *Q. alba* of ABBOTT and SMITH (*Insects of Georgia, pl. 85*) and of EMERSON's *Trees of Massachusetts*; and it is this form which later authors have usually considered to be the type of the white oak. This variety may be distinguished as

QUERCUS ALBA var. **latiloba**, n. var.—Differing from the type in its leaves less deeply divided into broad rounded lobes and in its usually smaller fruit.

3. The tree with obovate leaves with margins undulate or slightly lobed with broad rounded lobes. This is the *Q. alba* (*repanda*) of MICHAUX (Hist. Chênes Amér. *pl.* 5. *fig.* 2. 1801). According to MICHAUX this form of the white oak was common in his time in the Carolina forests, but I have never seen but one tree, and this is growing by the side of the road between Springfield and Ponchatoula in Tangipahoa Parish, Louisiana, where Professor COCKS and I found it on March 29, 1917, just as the staminate flowers were falling and when the tree was very conspicuous from the thick coat of silvery white tomentum which covered the lower surface of the half-grown leaves. COCKS collected fruiting specimens from this tree on October 3, 1917, when the leaves were glabrous, rounded at apex, undulate or slightly divided on the margins into short broad rounded lobes. The fruit is raised on a peduncle 1 cm. long and is 2.5 cm. in length, with unusually thickened turbinate cup-scales. A specimen ex herb. H. A. Gleason, without fruit, on which some of the leaves were of this form, was collected by *G. P. Clinton* at Herod, Illinois, in April 1898.

QUERCUS AUSTRINA Small, Fl. Southeastern U.S. 353. 1903.—In the original description of this tree it is said to attain a height of 15 m., with a trunk diameter of about 1 m. The bark is described as rough and the leaves as “whitish tomentulose but soon becoming glabrous and more or less glaucous beneath.” River banks, Georgia and Alabama, are given for the range.

It is probable that this description of the young leaves was made from a specimen of *Q. Durandii* Buckl., which often grows with *Q. austrina*, for the young leaves of *Q. Durandii* are white-tomentulose on the lower surface, while those of *Q. austrina* are always green and glabrous. Trees of *Q. austrina* are often 20–25 m. and occasionally 30–35 m. high, with trunks 1 m. in diameter. It ranges from the coast of South Carolina to western Florida, central Alabama, and central Mississippi, and although not generally distributed is not rare. The earliest specimens which I have seen were collected at Bluffton, South Carolina, in 1883 by MELLICHAMP, who considered it a hybrid.

It has been suggested (ASHE in Proc. Soc. Am. Foresters 11:89) that this is the *Q. sinuata* Walter (Fl. Car. 235), the leaves of which were described as

"supra pallidis, subtus subglaucis," but as the leaves of *Q. austrina* are bright green on both surfaces, WALTER'S *Q. sinuata* was probably not that species. The description of the leaves would better apply to *Q. Durandii* Buckl., although the leaves of that species are not "supra pallidis," but, "subplanis" might be used to describe the very shallow cups. *Q. Durandii*, however, is not known to grow in Carolina or nearer Charleston than Albany, Georgia, which so far as I know is the eastern station for this oak, and it is hardly safe to take up WALTER'S name for *Q. Durandii*, especially as his specimen is not found in his herbarium in the British Museum.

QUERCUS STELLATA Wang.—That the post oak should have developed many forms is not surprising, for it is distributed from southern Massachusetts to western Oklahoma and to western Texas, and is found on dry hillsides, sandy plains, and deep bottom lands often inundated for several weeks at a time. Except in size, the fruit of *Q. stellata* shows little variation, and the leaves, which vary greatly in shape and in the character of their pubescence, cannot be depended upon to separate the different forms. On what is considered the typical post oak the upper lateral lobes of the leaves are broad and truncate or slightly lobed at apex. On trees with leaves of this shape leaves are often found with the upper lobes narrowed and rounded at apex; and the clusters of fascicled hairs on the upper surface, which usually well distinguish through the season the northern or typical form of this tree, are often early deciduous or entirely wanting from other forms. On the northern tree the branchlets of the year are stout and thickly covered with pale tomentum, and on some of the southern forms the branches are more slender and glabrous or only slightly pubescent when they first appear, and in the branchlets is the best character I have found by which to group the different forms. The pubescence on the lower surface of the leaves of forms with glabrous branchlets is usually loose or floccose and sometimes deciduous. The close pubescence of fascicled hairs, however, found on the lower surface of the leaves of the typical post oak, is found also on some of the forms with the glabrous branchlets. Forms of the post oak with scaly bark, like that of the white oak, have always with one exception, so far as I have been able to observe, glabrous branchlets and occur only in the south, and the forms on which all or nearly all of the leaves have rounded lobes are also southern.

In the woods 12 miles west of Opelousas, Louisiana, in wet, often inundated ground, there are large post oaks with square lobed leaves glabrous on the upper surface in April, tomentose branchlets, and pale scaly bark. These trees most resemble, except in their bark, the typical post oak, but there is not now sufficient material available to make it possible to treat them as a variety. The following varieties with tomentose branchlets can be distinguished:

QUERCUS STELLATA var. **Boyntonii**, n. var.—*Q. Boyntonii* Beadle, Bilt. Bot. Studies 1:47. 1901.—Differing from the type in the shape of its obovate leaves mostly 3-5-lobed toward the apex with small rounded lobes, and in their yellowish brown pubescence. The leaves are oblong-obovate, gradually narrowed and cuneate or rarely rounded at base, and 3-5-lobed above the middle with broad rounded lobes; when they unfold they are stellate-pubescent above and tomentose below with a thick coat of rusty brown stellate hairs, and at maturity are subcoriaceous, dark green, lustrous and glabrous on the upper surface, tomentose on the lower surface, 9-12 cm. long and 4-7 cm. wide; petioles pubescent, 5-10 cm. in length. The cups of the fruit vary from cup shape to turbinate and their scales are thin and sometimes much thickened toward the base of the cup and are hoary tomentose.

A shrub or small tree spreading into thickets, 1-5 m. tall, with stems covered with rough dark gray furrowed bark, gray-brown branches, and branchlets coated during their first season with yellowish brown tomentum, and glabrous or slightly pubescent in their second season. In the shelter of narrow glades on the summit of Lookout Mountain above Gadsden and Attala, Etowah County, Alabama.

The dwarf habit of this little oak is due probably to the exposed position and high altitude where it grows. It is best distinguished from other forms of dwarf post oaks by the color of the yellow-brown pubescence on the leaves and branchlets, for the fruit is not different from that of the typical post oak, and the shape of the leaves is similar to that of many post oak leaves with rounded lobes.

QUERCUS STELLATA var. **attenuata**, n. var.—Differing from the type in the oblong to oblong-obovate narrow leaves 3-lobed at the apex with small, usually rounded lobes, the lateral rarely truncate at the apex, below slightly undulate or lobed with one or with two small lobes and gradually narrowed to the cuneate base;

at maturity glabrous, smooth or scabrate above and thickly coated below with pale pubescence, 8–14 cm. long and 3–4.5 cm. wide across the terminal lobes; petioles slightly pubescent, 1–1.5 cm. in length; spring leaves and flowers not seen. Fruit nearly sessile; acorn not more than 1.5 cm. long and inclosed for half its length in the turbinate cup 1–1.5 cm. in diameter. A tree with stout tomentose branchlets.

Arkansas Post on the White River, Arkansas County, Arkansas, *John H. Kellogg*, September 24, 1909. Judging by the number of specimens made by *Kellogg*, this must be a common tree at Arkansas Post. Unfortunately I have no notes on its size or the nature of the bark. The leaves resemble in shape those of var. *paludosa*, but the pubescence on the lower surface is not so dense, and the tomentose branchlets distinguish it from that variety.

QUERCUS STELLATA var. **parviloba**, n. var.—Differing from the type in the smaller lobes of the leaves and in their more prominent reticulate veinlets. Leaves obovate to oblong, acute or rounded at the narrow apex, cuneate or rounded at base; 3-lobed at apex or 5-lobed, with small rounded or acute lobes, or nearly entire with undulate margins; at maturity pubescent above, floccose-tomentose below, 6–8 cm. long and 2.5–4 cm. wide, with prominent pubescent midribs and conspicuous reticulate veinlets, or on vigorous shoots sometimes 9–10 cm. long and 4–6 cm. wide; petioles stout, rusty-tomentose, 5–8 mm. in length. Flowers and spring leaves not seen. Fruit as in the species.

A round-headed tree 8–10 m. high, with rough bark and stout branchlets covered with thick rusty brown tomentum during their first season, becoming darker colored and slightly tomentose during the following year, and globose terminal buds.

Dry sandstone hills near Brownwood, Brown County, Texas, *E. J. Palmer*, October 23, 1916 (no. 11105, type); sometimes planted as a street tree in Brownwood.

QUERCUS STELLATA var. **anomala**, n. var.—Differing from the type in its broadly obovate leaves, slightly 3-lobed and rounded at the apex. Leaves 4.5–7 cm. in length and 2.5–3.5 cm. in width, rounded and slightly 3-lobed at apex with broad rounded lobes and entire or undulate and gradually narrowed below to a rounded base; subcoriaceous, lustrous and glabrous above in autumn and tomentose below with a thick coat of fascicled hairs,

with prominent midribs and with the upper primary veins running to the points of the lobes larger than the others; petioles pubescent, 3-4 mm. in length. Flowers and spring leaves not seen. Cup of the fruit turbinate, 1-1.5 cm. in diameter, with scales not at all thickened, loosely appressed; nut not seen.

A tree 5-6 m. tall, with thick bark deeply divided into broad ridges covered with closely appressed scales, stout gray branches, branchlets thickly covered during their first season with rusty tomentum, and ovate obtuse pubescent buds.

Dry sandstone hills, Brownwood, Brownwood County, Texas, *E. J. Palmer*, October 18, 1917 (no. 13037, type), May 14, 1907 (no. 11906).

In the shape of the leaves this is the most abnormal of the forms of the post oak which I have seen and, as PALMER suggests, it may possibly be a hybrid between *Q. annulata* and *Q. stellata* which grow with it.

QUERCUS STELLATA var. **Palmeri**, nov. var.—Differing from the type in its narrow oblong or slightly obovate 5-7-lobed leaves with narrow lobes, in the dense tomentum on their lower surface, and in the thicker more closely appressed tomentose scales of the turbinate cup. The leaves are deeply divided by wide sinuses into narrow acute or rounded, or rarely obliquely truncate lobes and are obtusely pointed at apex, rounded at base, pubescent on the upper surface, coated below with a thick coat of pale tomentum of fascicled hairs, 8-9 cm. long and 3-5 cm. wide; petioles tomentose, 5-8 mm. in length. Flowers and spring leaves not seen. Fruit sessile or short-pedunculate, the cup turbinate with the lower scales often much thickened, and 1.2-1.8 cm. in diameter.

A shrub 2-3.5 m. high, with scaly bark, forming large clumps by underground stems, the tallest specimens in the center of the clump, the smallest near its margins.

Sandy uplands, Elk City, Beckham County, Oklahoma, *E. J. Palmer*, July 16, 1917 (nos. 12564, 13070, type).

QUERCUS STELLATA var. **rufescens**, n. var.—Differing from the type in the rusty brown pubescence on the lower surface of the polymorphous leaves and on the branchlets, in the deeper cups of the fruit, and in their thicker basal scales. The leaves are pubescent above throughout the season and thickly covered with close rusty brown pubescence on the lower surface. They are 5-6 cm. long, 1-1.5 cm. wide, rounded or acute at apex, rounded or

cuneate at base, slightly or deeply lobed with 2-4 pairs of rounded lobes, or undulate or rarely entire; on vigorous shoots they are oblong-obovate with the broad upper lobes of the leaves of the post oak, 6-7 cm. long and 3.5-4 cm. wide; petioles densely pubescent, 4-5 mm. in length. Leaves collected in the spring and flowers not seen. Leaves on some individuals oblong-obovate, broad or gradually narrowed and rounded at apex, cuneate at base, slightly divided into two or three pairs of broad rounded lobes, 5-7.5 cm. long and 3.5-4.5 cm. wide; on others oblong-obovate, 7-lobed, the lateral lobes of the upper pair rounded or truncate at apex, or occasionally 5-lobed, the truncate upper lateral lobes like those of the type. Fruit sessile or short-pedunculate; cup turbinate, rusty pubescent, the lower scales often much thickened, inclosing one-half to three-quarters of the nut, and 1.2-1.8 cm. in diameter.

Shrubs 4-5 m. high, with scaly bark, spreading by underground stems into large thickets, and slender branchlets thickly covered during their first two seasons with rusty brown pubescence; rarely small trees.

Sandy uplands, Elk City, Beckham County, western Oklahoma, *E. J. Palmer*, July 16, 1917 (no. 12570, type), October 25, 1917 (no. 13069).

TEXAS.—Big Springs, Howard County, *E. J. Palmer*, July 9 and October 23, 1917 (nos. 12489, 13063, 13064, with oblong-obovate leaves with rounded or truncate upper lobes. "In sandy soil this shrubby post oak grows in large clumps to a maximum height of 4 m.; it suckers freely and is a very conspicuous feature of the flora on account of its peculiar growth, dark green foliage, and greater height among large areas of *Q. Mohreana*"); Fort Chadburn, Coke County, *E. J. Palmer*, July 7, 1917 (no. 12462, "shrubs or small trees 2-3 m. high"); dry gravel hills, Sweetwater, Nolan County, Texas, *E. J. Palmer*, October 21, 1917 (no. 13054, with narrow slightly lobed or undulate leaves; "a tree 6-8 m. high; branches stout, rigid; bark rough").

The following varieties with glabrous or nearly glabrous branchlets can be distinguished:

QUERCUS STELLATA var. *MARGARETTA* Sargent in *Trees and Shrubs* 2:219. 1913.—*Q. minor* var. *Margaretta* Ashe, Jour. Elisha Mitchell Sci. Soc. 11:94. 1894; *Q. Margaretta* Small, Fl. South-eastern U.S. 355. 1903.—Differing from the type in the usually rounded lobes of the leaves soon glabrous on the upper surface, in the less dense sometimes nearly deciduous pubescence on the lower surface, and in the slender glabrous reddish branchlets.

This is the common post oak of the south Atlantic and Gulf states, where it grows usually on dry gravelly or sandy slopes and ridges, and is a small tree with close furrowed rough bark. Occasionally the leaves do not differ in shape from those of the typical northern post oak.

QUERCUS STELLATA var. *MARGARETTA* f. *stolonifera*, n. f.—I suggest this name for a form of this oak which is common near Selma, Dallas County, Alabama, which differs from the variety in habit and in its smaller leaves. It is a shrub usually only 1.5–2 m. high, spreading into thickets by stoloniferous shoots; the branchlets are glabrous or slightly pubescent when they first appear.

C. S. Sargent, April 19, 1915; *T. G. Harbison*, April 20, 1915; *R. S. Cocks* (no. 962, type), September 18, 1915.

It is probably this form which covers the dry sandy hills west of Oklahoma City, Oklahoma, with low dense thickets.

QUERCUS STELLATA var. *araniosa*, n. var.—Differing from the type in the usually smooth upper surface of the leaves, in the floccose persistent tomentum on their lower surface, and in the more slender yellow or reddish usually glabrous branchlets and scaly bark.

LOUISIANA.—Natchitoches Parish, Grand Ecore, *E. J. Palmer* (no. 8770, type), October 2, 1915; also *Palmer*, nos. 7518, 7978, 8769, 8838, 9446; *Chopin* 7361, 7978, 8838; Natchitoches 7361.

TEXAS.—Larissa, Cherokee County, *E. J. Palmer* (nos. 7840, 8607); Liberty, Liberty County, *E. J. Palmer* (no. 7723, a large tree with slightly scaly bark).

OKLAHOMA.—Antlers, Pushmataha County, *E. J. Palmer* (no. 8318); Broken Bow, McCurtain County, *E. J. Palmer* (no. 10491).

ARKANSAS.—Texarkana, Miller County, *E. J. Palmer* (no. 8985); Benton, Saline County (no. 8439).

ALABAMA.—Common in dry sandy soil near Selma, Dallas County, *R. S. Cocks*, September 15, 1915 (no. 956); *T. G. Harbison*, 1911–1916 (nos. 53, 54).

The leaves of this variety have sometimes square and sometimes rounded lobes, leaves with square and rounded lobes often appearing on the same branch. The fruit is sessile or occasionally raised on peduncles up to 1.6 cm. in length.

QUERCUS STELLATA var. *paludosa*, n. var.—Differing from the type in its oblong-obovate leaves, mostly 3-lobed above the middle, slightly pubescent branchlets sometimes becoming nearly glabrous, and in its scaly bark. Leaves oblong-obovate, gradually narrowed below into a long slightly undulate cuneate base, rarely furnished near the middle on one side, or on each side, with a small rounded

lobe, and 3-lobed toward the apex, the terminal lobe gradually narrowed and rounded at apex or sometimes divided into 3 small rounded terminal lobes, the lateral lobes gradually narrowed, rounded and entire, or broader, nearly truncate and slightly 2-lobed at apex; when they unfold thickly covered above with fascicled hairs and below with thick persistent tawny pubescence; at maturity thick, dark green, lustrous and scabrate on the upper surface, 8-12 cm. long and 4-6 cm. wide across the lobes, with stout midribs and two prominent veins running to the ends of the lobes, and thickened slightly revolute margins; petioles covered when the leaves first appear with pubescence, soon mostly deciduous, and 10-12 mm. in length. Flowers and fruit as in the species.

A tree 20-25 m. tall, with a trunk sometimes 1 m. in diameter, covered with pale bark separating into thin usually appressed scales, stout branches forming a narrow round-topped head, and slender branchlets dark red and sparingly stellate-pubescent when they first appear, and red-brown or gray-brown and slightly pubescent or nearly glabrous later in the season. Winter buds ovate, obtusely pointed, with red-brown pubescent scales.

In deep rich soil on the often inundated bottoms of Kenison Bayou, near Washington, St. Landry Parish, Louisiana, *Cocks* and *Sargent*, March 26, 1917, *R. S. Cocks*, October 12, 1917 (nos. 4730, 4732, 4734, type). At this station there are 8 trees of this distinct variety of the post oak.

QUERCUS MUEHLENBERGII var. **Brayi**, n. var.—*Q. Brayii* Small, Bull. Torr. Bot. Club 28:358. 1901.—The chestnut oak of western Texas differs from *Q. Muehlenbergii* Englem. only in its larger fruits, which are sometimes 3 cm. long with cups 1.5 cm. deep and 2.5 cm. in diameter, with slightly more thickened scales.

Such fruit is found on trees on the Edwards Plateau where this oak is not rare in low ground in the neighborhood of streams. The type tree is a large specimen on the bottom lands of a small stream at Lacey's Ranch near Kerrville, Kerr County. Farther west the fruit is smaller, and on the Guadalupe Mountains, which is the western known limit of the range of this chestnut oak, the fruit is small, with cups not more than 1.5 cm. in diameter.

QUERCUS UTAHENSIS var. **submollis**, n. var.—*Q. submollis* Rydberg, Bull. N.Y. Bot. Garden 2:202. 1901.—Differing from the type only in the thinner scales of the cup of the fruit.

Q. submollis as a species was based on the thin scales of the cup of the fruit. The cup-scales of *Quercus* do not, however, afford a valuable character

for distinguishing species, and in the case of *Q. utahensis* trees occur with cups showing a complete gradation between those with much thickened scales and those with only slightly thickened scales. Trees with the thickened and with the thin cup-scales occur over the whole region occupied by the species, but var. *submollis* seems rather more abundant on the Colorado plateau in northern Arizona where *Q. utahensis* and its variety are the largest and most abundant oaks.

QUERCUS ANNULATA Buckley, Proc. Phil. Acad. 1860. 445, is the earliest specific name for this white oak of western Texas, which was first described as *Q. obtusifolia* var. *breviloba* by TORREY in Bot. Mex. Bound. Surv. 206. 1895, and later by me as *Q. breviloba* in Garden and Forest 8:93. 1895.

Q. annulata grows on the dry limestone hills of central Texas and is a large or small shrub spreading into thickets, or rarely a tree 10–12 m. tall. I formerly united *Q. Durandii* Buckl. with this species. They both grow in the neighborhood of Austin, Texas, but the two trees differ in habit and in distribution, for *Q. annulata* is confined to the dry hills of central and western Texas, while *Q. Durandii* ranges eastward to Mississippi, Alabama, and Georgia, and is a large tree of bottom lands. They are well distinguished, too, by the larger leaves and by the shallower cups of the fruit of *Q. Durandii*. The leaves of these two oaks differ on different parts of the tree; on fertile branches they are usually covered below with pale tomentum; on lower branches and on vigorous shoots they are green and glabrous or nearly glabrous on the lower surface, and sometimes all the leaves are green on the lower surface. *Q. annulata* is the commonest “shin oak” on the Edwards Plateau of Texas, where with bushes 1–2 m. high it covers thousands of acres of dry limestone hills, or in the protection of bluffs and ravines occasionally becomes a tree 8–10 m. tall.

QUERCUS MOHRIANA Rydb.—This species must be added to the list of North American trees, for although usually a shrub not more than 1.5 m. high, E. J. Palmer has found it growing as a tree 7–8 m. tall, with a trunk 3 dm. in diameter, in the shelter of bluffs and ravines, Nolan County, Texas.

Q. Mohriana is common on the Staked Plains of Texas, and from Tom Green County northward it replaces *Q. annulata* Buckl. on the slopes and tops of dry calcareous hills.

QUERCUS VIRGINIANA Miller.—The fact that there are two distinct principal forms of the live oak in the southern states appears to have escaped the attention of most authors who have written about this tree. On one of the forms the leaves are comparatively

thin, with only slightly revolute margins and reticulate veins inconspicuous on the lower surface, which is covered with very short close pale pubescence. On the other form the leaves are much thicker, with conspicuously revolute margins and reticulate veins prominent on the lower surface which is covered with thick pale tomentum. The habit of the mature trees of the two forms is the same, and they both have the same dark gray furrowed bark and the same fruit.

At Biloxi, Mississippi, where these two forms are very abundant and grow together near the sandy shore of the Sound, on April 2, 1917, the leaves of the previous year had practically all disappeared from the first variety, the new leaves were nearly fully grown, and the staminate flowers had fallen, while the trees of the second variety still retained all the leaves of the previous season and showed no signs of vegetative activity. The leaves of the thin-leaved form usually show a tendency to undulate on the margins and are often lobed, especially on trees in western Texas, but on the thick-leaved form I have seen few lobed leaves. Occasionally trees of the thin-leaved form occur on which the leaves are thicker than usual, with thicker and more revolute margins, showing a tendency to intergrade with the other form, although usually the two forms appear very distinct. The thin-leaved form is the more widely distributed, and, except in the interior of the Florida peninsula, the more common tree. It is possibly a larger tree than the other; at least all the very large live oaks I have seen are of this variety. Of the thick-leaved form I have seen specimens outside of Florida only from Wrightsville and Southport, North Carolina, Bluffton, St. Helena Island, and Beaufort, South Carolina, Colonel's Island, Coffin County, Georgia, Fish River, Baldwin County, Alabama, and Biloxi, Mississippi. Although very common along the coast of Mississippi it does not, so far as I have observed, cross the Pearl River into Louisiana, and the great live oaks for which that state is famous are all of the other form.

It is not possible to determine precisely which of these two forms is the type of *Q. virginiana* Miller. The first description of this tree, published in 1696, was that of PLUKENET, *Quercus virginiana sem-pervirens, foliis oblongis sinuatis* and *non sinuatis* (Alm. Bot. 310). This description might apply to either form and equally well to

Q. laurifolia. CATESBY in his Natural History of Carolina describes and figures the live oak, and his specimen, which is preserved in the British Museum and of which Dr. RENDLE has permitted me to see a leaf, is the thin-leaved form. LINNAEUS based his *Q. Phellos* β (Spec. Pl. 994. 1753) on CATESBY's description and figure. There is no doubt therefore about LINNAEUS' plant, which he considered a variety of the willow oak. PHILLIP MILLER in the eighth edition of his Dictionary, published in 1768, first gave the live oak a specific name, *Q. virginiana*. In his description he refers BANNISTER'S *Q. sempervirens foliis oblongis non serratis* to his species. This oak, however, is not included in BANNISTER'S list of Virginia plants published by RAY, and this quotation may mean that MILLER received from BANNISTER a specimen or seeds with this descriptive phrase. Unfortunately, MILLER'S specimen has not been preserved; but as it is possible that his only information in regard to the live oak came from BANNISTER, and as BANNISTER lived in Virginia, where so far as is now known the thick-leaved form does not occur, it is perhaps safe to assume that the type of *Q. virginiana* Miller is the thin-leaved form, that is, the form known to CATESBY and the *Q. Phellos* β of LINNAEUS.

A narrow-leaved shrubby form of the thick-leaved tree growing in the sandy soil of the Florida peninsula has been described by SMALL as *Q. geminata*, and if the thin- and thick-leaved forms of the live oak are considered varieties of one species the name of the thick-leaved tree becomes

QUERCUS VIRGINIANA var. **geminata**, n. var.—*Q. virginiana* Sargent, Silva N.Am. 8:99 in part, *pl.* 395. *fig.* 3. 1895; *Q. geminata* Small, Bull. Torr. Bot. Club 24:438. 1897.—Differing from the type in the more prominently reticulate-venulose leaves hoary-tomentose below, their margins conspicuously thickened and revolute.

SMALL describes the leaves of *Q. geminata* as mostly oblong-elliptic or oblong-obovate. Such shaped leaves are common on Florida specimens, but on the Carolina and Biloxi specimens the leaves are often broadly oblong-obovate and similar in shape to those of some of the common forms of *Q. virginiana*. The statement that the acorns of *Q. geminata* are always in pairs is not borne out in fact, as the fruit on specimens collected by CURTISS near Jacksonville, Florida (2597), is solitary, and on a number of specimens of his also from

Jacksonville there are 3 fruits on the peduncle. The type of *Q. geminata* is described as a shrub or small tree 2-2.5 m. tall, with a trunk diameter of about 15 cm. Many of the Biloxi trees are 20-25 m. tall, with trunks up to 1 m. in diameter. A form of this variety may be distinguished as

QUERCUS VIRGINIANA var. *GEMINATA* f. **grandifolia**, n. f.—Differing from the variety in its much larger mostly oblong-elliptic leaves. Leaves oblong-elliptic to slightly obovate, acute or rounded at the apex, narrowed and cuneate or rounded at the base, slightly lobed above the middle, pale on the upper surface, tomentose on the lower surface, 10-12 cm. long and 3-5 cm. wide, with thickened revolute margins and conspicuous reticulate veinlets. A tree 10-12 m. high, with stout pubescent or tomentose branchlets.

In low woods in sandy soil. FLORIDA.—Zellwood, Orange County, *T. G. Harbison*, December 4, 1917 (no. 4, type); Apopka, Orange County, *T. G. Harbison*, December 4, 1917; Jacksonville, Duval County, *T. G. Harbison*, December 3, 1917 (no. 13); near Matanzas, St. John County, *T. G. Harbison*, November 4, 1917 (nos. 3, 4); Gainesville, Alachua County, November 11, 1917 (no. 48, with leaves not more than 7 cm. long and 3 cm. wide); San Mateo, Putnam County, *T. G. Harbison*, November 12, 1917 (no. 19); Sumner, Levy County, *T. G. Harbison*, September 25, 1917 (nos. 30, 40, 43).

The following varieties of the thin-leaved or typical *Q. virginiana* can be distinguished:

QUERCUS VIRGINIANA var. **virescens**, n. var.—Differing from the type in the green glabrous or rarely puberulous lower surface of the leaves and in the glabrous branchlets. Leaves thin, elliptic to oblong-obovate, acute or rounded at apex, gradually narrowed and cuneate at base, occasionally slightly undulate or rarely furnished, usually above the middle, with occasionally minute teeth thin (in June), dark green, glabrous and lustrous on the upper surface, green, lustrous, and sparingly and minutely pubescent or glabrous on the lower surface, 7-12 cm. long and 2.5-5 cm. wide, with prominent midribs, slender primary veins, inconspicuous veinlets, and thin margins slightly or not at all revolute; petioles slender, sparingly pubescent, 5-8 mm. in length. Flowers and fruit not seen.

FLORIDA.—A large tree in sandy soil, Gainesville, Alachua County, *T. G. Harbison*, June 17, 1917 (no. 48, type); Sanford, Seminole County, *T. G. Harbison*, May 27, 1917 (no. 1, with a few leaves lobed near the apex; no. 2, with

rather thicker leaves with more revolute margins, 5-8 cm. long and 1.5-3.5 cm. wide); Sumner, Levy County, *T. G. Harbison*, June 28, 1918 (no. 28); Simpson's Hammock, near Little River, Dade County, *C. T. Simpson*, October 1914; four miles west of Long Key, Everglades, Dade County, *E. A. Bessey*, May 1908 (no. 85).

On a specimen of a shoot from Little River the leaves are oblong, acute at apex, rounded at base, acutely lobed, sometimes with three terminal lobes and sometimes with numerous lateral lobes.

QUERCUS VIRGINIANA var. **macrophylla**, n. var.—Differing from the type in its much larger ovate or slightly obovate leaves, rounded or cuneate at base and rounded or acute at apex, entire or occasionally repand-dentate, and coated below with short pale or nearly white tomentum.

Sandy bottoms of the Atascosa River, and in flat woods just above the river, Pleasanton, Atascosa County, Texas, *E. J. Palmer*, September 23, 1916 (no. 1079, type), May 17, 1916 (no. 9784).

In the shape and size of the leaves, which are 7-10 cm. long and 3-6 cm. wide, and borne on stout pubescent petioles 4-5 mm. in length, this tree is unlike any of the forms of the live oak which in its typical form is common on dry hills in the neighborhood. The fruit is solitary or in pairs, and is borne on peduncles which are 1-5 cm. in length. PALMER reports that there are a number of good sized trees in these groves.

QUERCUS VIRGINIANA var. **eximea**, n. var.—Differing from the type in its narrow elliptic to narrow oblong-obovate leaves, in its smaller size and pale bark. Leaves narrow elliptic to narrow oblong-obovate, abruptly or gradually narrowed and apiculate at the acute apex, gradually narrowed and cuneate at base, on vigorous shoots sometimes lobed on each side near the base, and occasionally near the apex with small acute lobes; when they unfold sparingly pubescent above and thickly covered below with hoary pubescence, and at maturity dark green, lustrous and glabrous on the upper surface, covered on the lower surface with matted pale hairs, 3-5 cm. long and 1-2 cm. wide, with only slightly revolute margins and inconspicuous veins; petioles pubescent, 4-5 mm. in length. Flowers like those of the species; fruit usually smaller with nuts not often more than 1 cm. long and cups 1.2-1.5 cm. in diameter.

A tree 5-7 m. high, with a short trunk 20-30 cm. in diameter covered with pale only slightly furrowed bark, pendulous branches forming a round-topped

head, and slender branchlets covered when they first appear with fascicled hairs and glabrous or nearly glabrous in the autumn; often a shrub not more than 2 m. tall.

In dry sandy open woods, eastern Louisiana, near Springfield, Livingston Parish, *R. S. Cocks* and *C. S. Sargent*, March 27, 1917, *R. S. Cocks*, October 2, 1917 (no. 4716, type); near Hammond, Tangipahoa Parish, *R. S. Cocks*, October 2, 1917 (nos. 4720, 4726, shrubs); Pearl River, *R. S. Cocks*, October 2, 1917 (nos. 4718, 4722, shrubs).

In the texture of the leaves and their slightly revolute margins and inconspicuous veins this variety resembles what is here considered the typical *Q. virginiana*, from which it differs in the small size of the leaves and fruit, in the pale nearly smooth bark, in the more glabrous branchlets, and in its smaller size. So far as I know, this variety has been found only at a few stations in eastern Louisiana and probably is not common.

QUERCUS VIRGINIANA var. fusiformis, n. var.—*Q. fusiformis* Small, Bull. Torr. Bot. Club 23:357. 1901.—Differing from the type in its smaller leaves and smaller size. The leaves are oblong to oblong-obovate, acute at apex, rounded or cuneate at base, entire, or occasionally dentate above the middle, coated below with pale pubescence, 2–2.5 cm. long and 8–10 mm. wide, with slightly thickened and revolute margins. Fruit smaller than in the type and as often short-oblong as fusiform.

A shrub 1–4 m. high, with ridged horizontal or slightly ascending branchlets densely tomentose or pubescent in their first season.

Dry limestone ridges and flat topped hills of the Edwards Plateau, Texas; Lacey's Ranch, near Kerrville, Kerr County, *E. J. Palmer*, June 10, 1917 (no. 12224); "Devil's Back Bone," near Fischer's Store, Coval County, *E. J. Palmer*, June 6, 1917 (no. 12202).

This little live oak grows always in the neighborhood of larger trees of *Q. virginiana*, which it resembles in everything but in its dwarf habit and small leaves, due probably to the exposed and dry situation where it grows.

QUERCUS VIRGINIANA var. DENTATA Chapman, Fl. 421. 1861.—*Q. virginiana* var. *minima* Sargent, Silva N.Am. 8:101, pl. 396. 1895; *Q. minima* Small, Bull. Torr. Bot. Club 24:438. 1897.—This little oak, which is common in sterile pine barrens near the Florida coast and often bears large crops of fruit when not more than 3 dm. high, is distinct in the lower leaves, which are oblong-obovate, acute at the broad apex, coarsely repand-dentate with large triangular teeth, 7–10 cm. long and 2–3 cm. wide, the upper leaves

being oblong-lanceolate and entire. The fruit is usually larger, with shorter peduncles than on large trees.

QUERCUS VIRGINIANA var. MARITIMA Sargent, Silva N.Am. 9:100. 1895.—*Q. virens* (*maritima*) Michx. Hist. Chênes Amér., No. 7, pl. 13. fig. 3. 1801; *Q. virens* var. *maritima* Chapman, Fl. 421. 1860.—Leaves oblong-obovate to rarely lanceolate, acute and apiculate or rounded at apex, gradually narrowed and cuneate at base, entire or slightly and irregularly toothed above the middle, 5–8 cm. long and 1–1.5 cm. wide. Fruit solitary or in pairs, on peduncles 1–5 cm. in length. A shrub often not more than 2 dm. tall.

Dry sandy barrens, coast of South Carolina to Miami, Dade County, Florida. *Q. succulenta* Small (Fl. Southeastern U.S. ed. 2, 1332) from Dade County, Florida, appears to be a form of the var. *maritima* with the fruit in elongated spikes.

QUERCUS VIRGINIANA var. PYGMAEA, n. var.—Differing from the type in the usually 3-lobed leaves and in its smaller size. Leaves oblong-ovate, gradually narrowed and cuneate at the entire base, 3- or occasionally 5-lobed at apex with small acute lobes, or rarely elliptic and entire, glabrous on the upper surface, slightly pubescent at maturity on the lower surface, 3.5–6 cm. long and 2–2.5 cm. wide, with thin slightly revolute margins and inconspicuous veinlets; petioles 4–5 mm. in length, pubescent. Fruit nearly sessile or raised on short peduncles, the nut 1–1.5 cm. long and inclosed nearly to the apex. A shrub rarely more than 1 m. tall, with reddish brown stems and puberulous branchlets.

FLORIDA.—Pine woods in sandy soil, Zellwood, Orange County, *C. H. Baker*, August 1915 (type); dry river banks near Jacksonville, Duval County, *A. H. Curtiss*, November 1893 (without number); Sanford, Seminole County, *C. S. Sargent*, April 4, 1886; Sopchoppy, Wakulla County, *W. M. Canby*, April 3, 1895; vicinity of Fort Myers, Lee County, *Jeanette P. Standley*, June 26, 1916 (no. 289, with smaller thin leaves hoary-tomentose on the lower surface; perhaps another form).

GEORGIA.—Sandy soil near the coast, Brunswick, Glynn County, *T. G. Harbison*, November 3, 1913 (no. 32, with smaller fruit and shallower cups).

This variety appears to have been usually confused with var. *dentata*, but from that variety it differs in the absence of the large, many lobed leaves at the base of the stems and in the smaller fruit.

In the central peninsula of Florida, especially after the forest floor has been burned, small plants of the thick-leaved live oak spread by underground stems into large thickets of small stems which often bear lanceolate or narrow obovate leaves acute or rounded at apex and entire or irregularly toothed with small apiculate teeth. Some of these stems survive for many years and form a ring of smaller trees around the large central tree. The small plants in these clusters rarely produce fruit. In western Texas the live oak often spreads also by underground stems and forms clusters of considerable size.

An abnormal shrubby form of the live oak, with fruit in many fruited spikes 9–10 cm. long was collected by G. V. NASH in the vicinity of Eustis Lake, Lake County, Florida, April 1894 (no. 1762) and was distributed under the name of *Quercus virens spicata* Chapman. This name does not appear to have been published, and I have seen no other specimens like this no. 1762.

HYBRID OAKS

Quercus Hastingsii, n. hyb. (*Q. marilandica* × *texana*).—Leaves broadly obovate to ovate, rounded or abruptly cuneate at the wide base, 5-lobed halfway to the midrib by usually wide sinuses rounded in the bottom, the terminal lobe oblong, slightly 3-lobed at apex, the upper lateral lobes wide and slightly 2-lobed or rounded and entire at apex, more than twice as large as the entire rounded or acute lower lobes; at maturity thin, lustrous and glabrous on the upper surface, paler and glabrous on the lower surface, 6–7 cm. long and 5–6 cm. wide, with pubescent midribs and conspicuous axillary tufts of pale hairs; petioles slender, pubescent, 10–12 mm. in length. Flowers and spring leaves not seen. Cup of the fruit turbinate, covered with broad loosely appressed scales, gradually narrowed and rounded at apex and hoary-tomentose except on the margins, those of the upper rank conspicuously ciliate; fruit not seen.

A tree with a trunk 20 cm. in diameter, with branchlets thickly coated during the first season, with close pale tomentum, and small ovate pubescent winter buds.

TEXAS.—Near Boerne, Kendall County, *S. H. Hastings*, October 1910 (type); Woods along small creek, Brownwood, Brown County, *E. J. Palmer*, October 18, 1917 (no. 13056, with branchlets becoming nearly glabrous).

In shape the leaves of this tree differ from those of *Q. texana* in the shallower sinuses and in the less deeply divided terminal lobe, but, with the exception of the pubescence along the midribs and on the veins, most resemble the leaves of that species although they have conspicuous axillary tufts. The influence of *Q. marilandica* is seen in the broad tomentose scales of the cup, in the tomentose branchlets, and in the short tomentose winter buds.

I take much pleasure in associating with this interesting tree the name of its discoverer, S. H. HASTINGS, for many years at the head of the United States Agricultural Experiment Station at San Antonio, Texas.

Quercus beaumontiana, n. hyb. (*Q. rhombica* × *rubra*).—Leaves rhombic to oblong or oblong-obovate, acute at the ends, entire or undulate, and at the ends of the branchlets, deeply 3-lobed at apex with acuminate lobes and undulate and occasionally slightly lobed below; at maturity thin, smooth, and glabrous on the upper surface, sparingly pubescent on the lower surface, those with undulate or obscurely lobed margins 7–8 cm. long and 3–4 cm. wide, the terminal lobed leaves 9–12 cm. long and 5–7 cm. wide across the lobes; petioles slender, glabrous, 1–2.5 cm. in length. The fruit is that of *Q. rhombica*.

A tree with glabrous branchlets and oblong-ovate glabrous winter buds.

A single tree growing in a row of trees on a street leading out to Magnolia Cemetery, Beaumont, Jefferson County, Texas, and probably transplanted from woods in the neighborhood, *E. J. Palmer* (no. 12748, type). Another tree growing on a street west of Beaumont with undulate leaves coated below with pale pubescence as they unfold and glabrous branchlets is possibly the same hybrid (*C. S. Sargent*, April 11, 1915).

QUERCUS MELLICHAMPII Trelease, Proc. Am. Phil. Soc. 56:50. 1917 (*Q. Catesbaei* × *laurifolia*) (nomen nudum).—To an oak which was found many years ago on a sandy ridge by *J. H. Mellichamp* near Bluffton, South Carolina (see SARGENT, *Silva N.Am.* 8:144. pl. 419), TRELEASE has given the name of its discoverer. This oak, as ENGELMANN pointed out long ago, has every evidence of being a hybrid between *Q. Catesbaei* Michx. and *Q. laurifolia* Michx.

Trees which are evidently the result of the same cross are not rare in San Mateo, Putnam County, Florida, and in the neighborhood of Orlando, Orange County, Florida, where several trees of this hybrid growing in the woods in

dry sandy soil sometimes reach a height of 20 m. and form trunks 40–50 cm. in diameter, covered below with nearly black deeply furrowed bark. In the neighborhood of Orlando this tree is called silver oak from the pale color of the smooth upper stem and large branches. On the Florida trees sometimes occur lanceolate or oblong-elliptic entire leaves which I have not seen on the specimens collected near Bluffton by MELlichamp. In Florida the leaves of these trees begin to fall in December and fall gradually during the winter. My attention was first called to the silver oak in April 1915 by C. H. BAKER of Zellwood, near Orlando. It has been since collected in Orange County and in the neighborhood of San Mateo by T. G. HARBISON and myself.

QUERCUS DUBIA Ashe, Jour. Elisha Mitchell Sci. Soc. 11:93. 1894.—*Q. atlantica* Ashe, Proc. Soc. Am. Foresters 11:88. 1916; *Q. sublaurifolia* Trelease, Proc. Am. Phil. Soc. 56:52 (nomen nudum). 1917; (*Q. cinerea* × *laurifolia*).—The specimens which I believe represent this hybrid all have rather thick leaves pubescent on the lower surface and pubescent branchlets. The leaves vary greatly in shape and size; those of the type of *Q. dubia* from Abbotsford, Bladen County, North Carolina, are oblong, acute at apex, unsymmetrical and rounded at base, sometimes slightly falcate, 14–16 cm. long and 5.5–7.5 cm. wide. Specimens with similar leaves were collected at Jacksonville, Florida, by A. H. CURTISS many years ago. Unfortunately these specimens are not numbered or dated. He considered them a large-leaved form of *Q. laurifolia*. The type of *Q. atlantica* collected by Ashe at Lumber City in southern Georgia has many of the leaves obovate and rounded at apex and others elliptic or lanceolate and acute, resembling in size and shape those of *Q. laurifolia* and sometimes, like those of that species, they are slightly lobed toward the apex. The fruit of this hybrid is nearly sessile or distinctly pedunculate. On some trees it has the shallow cups of *Q. laurifolia* and on others cups as deep and broad as those of the large fruited forms of *Q. cinerea*. The trees of this oak which I have seen in Florida were not more than 12 m. high, with trunks 35–40 cm. in diameter, covered with dark deeply furrowed bark resembling that of *Q. cinerea* and with stiff erect branches forming an open head.

In addition to the specimens collected by CURTISS and ASHE I have seen specimens which seemed to belong to this hybrid collected by T. G. HARBISON in 1917 at Abbotsburg, Bladen County, North Carolina; Saint Helena Island

and Port Royal, Beaufort County, South Carolina; Lumber City, Telfair County, and Climax, Decatur County, Georgia; Jacksonville, Duval County, Gainesville, Alachua County, San Mateo, Putnam County, Zellwood, Orange County, Lake City, Columbia County, Florida; and from Mississippi City, Lincoln County, Mississippi.

Quercus Bushii, n. hyb. (*Q. marilandica* × *velutina*).—Leaves broadly obovate, rounded or rarely acute at base, 5-lobed with broad acute conspicuously apiculate lobes, the lobes of the lower pair much smaller than the others, or sometimes 3-lobed, the terminal lobe entire or sometimes minutely 3-lobed at apex; at maturity thick, dark green, lustrous and glabrous on the upper surface, yellowish brown and glabrous with the exception of a slight pubescence on the lower side of the midribs, 10–12 cm. long and 6–10 cm. wide, the veins running to the points of the lobes much larger than the others; petioles stout, floccose-pubescent, becoming nearly glabrous, 1–1.5 cm. in length. Flowers and spring leaves not seen. Fruit sessile, the nut ovate, rounded at the broad apex, finally becoming nearly glabrous, inclosed for one-half to nearly two-thirds of its length in the turbinate cup; cup-scales loosely appressed, broad and rounded at apex, hoary-pubescent, those of the upper ranks ciliate at the apex.

A tree with stout pale pubescent or in the autumn nearly glabrous branchlets and ovate acuminate narrow winter buds, the scales of the outer ranks covered with pale or rufous silky pubescence.

OKLAHOMA.—Sapulpa, Creek County, *B. F. Bush*, September 20, 1895 (no. 1328, type).

MISSISSIPPI.—Oxford, Lafayette County, *T. G. Harbison*, October 16, 1915 (no. 16, with larger leaves 5 or rarely 7-lobed, and larger fruit).

ALABAMA.—Dothan, Houston County, *T. G. Harbison*, May 23, 1917 (no. 8, a small tree); near Berlin, Dallas County, *R. S. Cocks* (no. 1002); bank of Mobile Bay at Daphne, Baldwin County, *C. S. Sargent*, October 14, 1913. A large tree with pendulous branches, nearly glabrous branchlets, and pubescent winter buds, close dark bark and shallower cups than those of the Oklahoma tree. The leaves on the fertile branchlets of this tree are 3-lobed, but at the ends of vigorous shoots they are narrow-obovate to oblong and are slightly divided into 3 or 4 pairs of lateral lobes. Mount Vernon, Mobile County, *T. G. Harbison*, May 19, 1917 (no. 21, without fruit and possibly a hybrid between *Q. Catesbaei* and *Q. marilandica*).

FLORIDA.—Sumner, Levy County, *T. G. Harbison*, June 16, 1917 (no. 3 A, "medium-sized tree in low hammocks").

GEORGIA.—Climax, Decatur County, *T. G. Harbison*, November 6, 1917 (no. 7).

QUERCUS SUBFALCATA Trelease, var. **microcarpa**, n. hyb. (*Q. Phellos* × *rubra* ?).—Leaves oblong-lanceolate to oblong-obovate, acuminate at the ends, slightly divided into numerous small acuminate lateral apiculate lobes, glabrous above, coated below with close pale pubescence, often becoming glabrous late in the season, 7–9 cm. long and 1.5–2 cm. wide; petioles slender, tomentose, sometimes becoming nearly glabrous late in the season. Fruit solitary or in pairs, short-stalked, 1 cm. long, with a shallow turbinate cup with closely appressed pubescent scales rounded at apex, and inclosing about one-third of the ovate acute pubescent nut.

A small tree with slender reddish branchlets thickly coated early in the season with pale tomentum, becoming glabrous in the autumn, and small ovate acute glabrous winter buds.

The parentage and history of this oak are not clear. There can be little doubt, however, that it owes its narrow leaves to *Q. Phellos*, and no other oak but *Q. rubra* L. could produce a hybrid hardy in Massachusetts with the pale pubescence of this plant.

This oak was obtained by the Arnold Arboretum in 1903 from the Wezelenberg Nurseries at Hazerswoude, Holland, under the name of *Q. chinensis microcarpa*, and is now well established here, having begun to produce fruit in 1909.

In September 1913 I found what seems to be the same plant growing in a bed of seedlings said to be *Q. coccinea* planted by Mr. C. S. MANN in his garden at Hatboro, Pennsylvania.

Q. subfalcata (*Q. Phellos* × *rubra*) Trelease has much larger, less lobed, and less pubescent leaves, and larger fruit, and is a native of southern Arkansas and eastern Texas.

Quercus guadalupensis, n. hyb. (*Q. macrocarpa* × *stellata*).—Leaves oblong-obovate, rounded at apex, gradually narrowed and rounded at base, 5- or rarely 7-lobed, the lateral lobes rounded or broad and truncate at apex; at maturity thin, bluish green, smooth and glabrous on the upper surface, coated below with loose pubescence, 8–10 cm. long and 4.5–6 cm. wide, with prominent pubescent midribs; petioles pubescent, 8–10 mm. in length. Spring leaves and flowers not seen. Fruit solitary, sessile or short-pedunculate,

the nut ovate, gradually narrowed and rounded at apex, puberulous, 2.5–3 cm. long and 2 cm. in diameter, and inclosed for one-third of its length in the cup-shaped cup covered with acuminate hoary-tomentose scales, those of the upper ranks forming a ciliate marginal ring.

A tree with stout branchlets covered during their first season with rusty brown tomentum, becoming gray and glabrous the following year, and ovate acuminate puberulous winter buds.

On a rocky creek bank at Fredericksburg Junction in the valley of the upper Guadalupe River, Kendall County, Texas, *E. J. Palmer*, October 1, 1916 (no. 10878, type).

In shape and size the leaves of this tree are intermediate between those of its supposed parents; the pubescence on their lower surface is that of *Q. stellata*. The fruit in size resembles that of *Q. macrocarpa*, but the scales of the cup are less acuminate than those of that species, and the marginal fringe of the cup is only slightly developed. The tomentum of the branchlets is that of *Q. macrocarpa*.

Quercus Andrewsii, n. hyb. (*Q. macrocarpa* × *undulata*).—Leaves oblong-obovate, acute or rounded at apex, rounded at base, divided into 7 or 9 narrow acute or rounded lobes by narrow sinuses rounded in the bottom and extending sometimes halfway to the midrib; at maturity light green and scabrate by the remains of clusters of fascicled hairs on the upper surface, paler and floccose pubescent on the lower surface, 9–12 cm. long and 4.5–6 cm. wide; petioles stout, pubescent, 10–12 mm. in length. Flowers and spring leaves not seen. Nut ovate, narrowed, rounded and depressed at apex, covered with short pale pubescence, 2.5 cm. long, 1.8 cm. in diameter, the cup turbinate with acute hoary-tomentose scales thickened on the back, those of the upper ranks abruptly narrowed into long slender tips forming a marginal ring.

A clump of large shrubs spreading by underground stems, with stout pubescent orange-red branchlets marked by numerous pale lenticels.

Seiling, Dewey County, Oklahoma, growing with its supposed parents, *D. M. Andrews*.

The influence of *Q. macrocarpa* is evident in the lyrate leaves, in the large fruit and its cup-scales, and in the color of the branchlets. The dwarf habit, the underground stems, and the pubescence on the under surface of the leaves show the influence of the other parent. This is one of the most distinct and interesting of the hybrid oaks of North America, and I am glad to associate with it the name of its discoverer, D. M. ANDREWS, of Boulder, Colorado.

Quercus jolonensis, n. hyb. (*Q. Douglasii* × *lobata*).—I suggest this name for a number of large trees at Jolon and between Jolon and King City, Monterey County, California, with characters intermediate between those of *Q. Douglasii* Hook and Arn. and *Q. lobata* Née, with which they are growing and of which they are probably hybrids. They have usually the lobed leaves of *Q. lobata* but are bluish in color, and occasionally one of the entire leaves of *Q. Douglasii* occurs on the specimens. The nuts generally resemble in size and shape those of *Q. lobata*, but occasionally are thickened at the middle like those of *Q. Douglasii*, but the cup is shallow, sometimes saucer-shaped, and the cup-scales are sometimes slightly thickened on the back, although much less so than those of *Q. lobata*, and sometimes are thin and not distinguishable from those of *Q. Douglasii*.

Miss Alice Eastwood, September 18, 19, and 20, 1894 (nos. 44, 154, 155, 156, 163, 164 type, 165).

Quercus Comptonae, n. hyb. (*Q. lyrata* × *virginiana*).—*Q. lyrata* Sargent (not Walter), Silva N.Am. 8:48 in part. *pl.* 374. *figs.* 5, 8. 1895.—Leaves oblanceolate, acuminate at apex, gradually narrowed into a long cuneate entire base, deeply repandly lobed with 3 or 4 pairs of nearly triangular lateral lobes pointing forward; covered above with scattered fascicled hairs and coated below with soft close pubescence when they unfold, becoming thick, dark green, glabrous and very lustrous on the upper surface, pale and pubescent on the lower surface, 6–9 cm. long and 3–4 cm. wide, with slightly thickened revolute margins, prominent glabrous midribs, and veins extending to the points of the lobes; on the lower branches often broadly obovate, rounded or abruptly acute and slightly 3-lobed at apex, or rarely entire and sometimes 10 cm. long and 6 cm. wide; petioles pubescent early in the season, becoming glabrous, about 1 cm. in length. Staminate flowers in slender villose aments; calyx sparingly villose, divided to below the middle into 5 rounded lobes much shorter than the slender filaments; anthers short-oblong, apiculate, glabrous. Pistillate flowers hoary-tomentose, single or in pairs, or rarely in threes, on slender pubescent peduncles 2–4 cm. long. Fruit ripening at the end of the first season; nuts

oval to oblong-ovate, abruptly pointed, light chestnut brown, about 2.5 cm. long and 1.5–1.8 cm. in diameter, inclosed for two-thirds or three-quarters of their length in the thin deep cup-shaped cup, the scales all thin, broadly ovate, narrowed and abruptly short-pointed at apex, pale pubescent, their tips free, those of the upper ranks forming a serrate rim to the cup.

A tree sometimes 35 m. high, with a tall straight trunk 1–1.5 m. in diameter, covered with deeply furrowed dark red-brown bark, erect and spreading branches forming a broad head, and slender branchlets sparingly pubescent when they first appear, and glabrous, lustrous, and light reddish brown at the end of their first season. Winter buds ovate-oblong, acute, about 0.05 cm. in length, their scales light chestnut brown, puberulous.

Duncan Park, Natchez, Adams County, Mississippi, Miss *C. C. Compton* and *C. S. Sargent* (no. 1, type), April 17, 1915, Miss *Compton*, November 1915.

ALABAMA.—Near an abandoned house in sandy soil 30 miles west of Selma, Dallas County, *T. G. Harbison* (no. 10), April 20 and October 21, 1915.

LOUISIANA.—Audubon Park and streets of New Orleans, *R. S. Cocks*, October 1911.

TEXAS.—Banks of Peyton's Creek, Matagorda County, *C. Mohr*, December 18, 1880.

Specimens of this tree appear to have been first collected by Dr. MOHR in Texas. These specimens were referred by me in *The Silva of North America* to *Q. lyrata*, with the statement that these were the only acorns of *Q. lyrata* I had seen with cups inclosing only one-half or two-thirds of the nut. The Texas tree or trees have probably disappeared, as *E. J. Palmer* has failed to find them in a careful search along both banks of Peyton's Creek from source to mouth. I first saw this tree in Duncan Park, Natchez, on the estate of the late Dr. STEPHEN DUNCAN, where there is a large specimen in the rear and not far from the Duncan mansion. Later Miss COMPTON succeeded in locating 20 or 30 of these trees in Natchez and its neighborhood. They are all large trees in the neighborhood of dwellings with the exception of two seedlings growing in the woods near the city. The largest and handsomest of these trees which I have seen is growing in the garden of St. Joseph's School, on State Street, Natchez. Another very large tree is standing in "Magnolia Vale" under the bluff at Natchez. The trees in New Orleans which are not large are said to have been brought from across Lake Pontchartrain 30 or 40 years ago, but Professor COCKS, who has carefully searched for this oak, has failed to find any trees in Louisiana with the exception of those planted in New Orleans. The Texas trees seen by MOHR may have been growing naturally in the woods, but all the others now known, with the exception of the two or three young trees which have sprung up naturally in the woods near Natchez, are evidently trees that have been planted. I am inclined

to believe that this oak is a hybrid probably between *Q. lyrata* and *Q. virginiana*. The shape and texture of the leaves suggest the former, but they are thicker and more lustrous than those of *Q. lyrata*. In these characters and in their pubescence they resemble those of *Q. virginiana*. The long-stalked fruit with the thin cup-scales has a general resemblance to the fruit of the live oak; from that of *Q. lyrata* it differs in the scales of the cup which are never thick at the base, in the shape of the cup pubescent on the inner surface, that of *Q. lyrata* being glabrous, and in the shape of the oblong-ovate nuts, which are never subglobose or short-ovate like those of *Q. lyrata*. The hybrid origin of *Q. Comptonae* is further borne out by the fact that H. NESS has raised artificially a hybrid oak between *Q. lyrata* and *Q. virginiana*, the fruit and the leaves of which, although smaller than those of the Mississippi trees, almost exactly resemble them in shape.

I take much pleasure in naming this tree, which is one of the handsomest American oaks, for Miss C. C. COMPTON, of Natchez, who has worked industriously to make it possible for me to understand it, and who has greatly aided the Arboretum by gathering material of the woody plants of Adams County, Mississippi.

Quercus Harbisonii, n. hyb. (*Q. stellata* var. *Margaretta* × *virginiana* var. *geminata*).—Leaves oblong-obovate to oblong, rounded at apex, gradually narrowed and cuneate at base, 3- or 5-lobed with acute or rounded apiculate lobes, or nearly entire with irregularly undulate margins and occasionally furnished with one or with two minute lobes below the middle; at maturity thick, bluish green, scabrate and lustrous on the upper surface, covered on the lower surface with loose pubescence, 6–7 cm. long and 2–4.5 cm. wide, with thickened slightly revolute margins, pubescent midribs and veins, and conspicuous reticulate veinlets. Flowers and spring leaves not seen. Nut oblong-ovate, gradually narrowed and rounded at apex, light chestnut brown and lustrous, about 2 cm. long, inclosed for one-third of its length in the turbinate cup covered with closely appressed hoary-tomentose scales, those near the base of the cup slightly thickened on the back.

A tree 5–6 m. high, divided near the ground into two stems covered with rough gray bark, and slender reddish branchlets pubescent during their first season and dark reddish brown and nearly glabrous in their second year, and ovate obtuse winter buds covered with chestnut brown nearly glabrous scales.

A single tree in sandy soil, Jacksonville, Florida, *T. G. Harbison* and *C. S. Sargent*, December 3, 1917.

This plant has every appearance of being a *Q. stellata-virginiana* cross. The thickened leaves with thickened revolute margins and the conspicuous reticulate veinlets point to var. *geminata* of *Q. virginiana* as one of the parents; the narrow and often rounded lobes of many of the leaves, the character of the pubescence on their lower surface, and the slender reddish slightly pubescent branchlets and globose nearly glabrous buds point to var. *Margaretta* of *Q. stellata* as the other parent.

A small tree 4-5 cm. tall found by *E. J. Palmer* at Fort Chadbourn, Coke County, Texas, July 9, 1917 (no. 12463), is probably a hybrid between the typical *Q. virginiana* and one of the dwarf forms of *Q. stellata*, but without fruit it is not desirable to describe it.

In the hope of drawing attention to them, names are proposed for the following hybrid oaks, although the material available is not sufficient to make their description possible:

Quercus Lowellii, n. hyb. (*Q. borealis* × *ilicifolia*).

Seabury, York County, Maine, *Percival Lowell*, September 8, 1914 (without fruit).

Quercus oviedoensis, n. hyb. (*Q. cinerea* × *myrtifolia*).

Oviedo, Orange County, Florida, *T. G. Harbison*, May 29, 1917 (nos. 19, 20, type). A small tree with leaves intermediate in shape between those of its supposed parent.

Quercus Cocksii, n. hyb. (*Q. rhombica* × *velutina*).

Pineville, Rapides Parish, Louisiana, *R. S. Cocks*, April 18, 1917 (no. 4702, type). The leaves of this tree generally resemble in shape those of *Q. rhombica*, but occasionally are slightly lobed and are rusty and thickly covered below with pubescence.

ARNOLD ARBORETUM
JAMAICA PLAIN, MASS.